

DESCRIPTION OF *AUSTROCHAPERINA* A NEW GENUS
OF ENGYSTOMATIDÆ FROM NORTH AUSTRALIA.

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(Figs. 35-40, and Plates viii., ix.)

In the collection of the Australian Museum are three frogs representing three species of a new genus. While in quest of additional material I was permitted through the kindness of Mr. George Masters, Curator of the Macleay Museum, to examine the collection of that Institution, and was fortunate enough to find a bottle containing ten specimens of frogs which represent two species identical with my own. This collection is from the Russell River, North-east Queensland, and contains nine specimens of one species (*A. robusta*, mihi.), and one of another (*A. ornata*, mihi.). My thanks are due to Professor W. A. Haswell, M.A., for his kind permission to borrow these frogs for descriptive purposes, and for granting an exchange of specimens which enabled me to dissect an example.

An examination of the sacral vertebræ and sternal apparatus of *A. robusta* proves that it belongs to the family Engystomatidæ, which up till the present was unrecorded from the Australian continent. These frogs represent a new genus whose affinities are with *Chaperina*, Mocquard, found in Borneo and New Guinea, and for which I propose the name *Austrochaperina*.

I wish to thank Mr. Charles Hedley for his kind endeavour to procure additional specimens at considerable inconvenience to himself and Mr. A. R. McCulloch for his ever ready assistance.

AUSTROCHAPERINA, *gen. nov.*

Pupil oval or nearly round, horizontal. Tongue oval or sub-circular, entire,¹ and free behind. Vomerine teeth none. Palatine ridges weak, oblique. Two transverse dermal ridges across the hinder palate. The anterior is short, usually not serrated being represented by a single dermal lobe, and is situated between the

¹ The tongue appears to be subject to much variation due to contraction in preservation, and is thus rendered almost useless as a character. In one specimen of *A. gracilipes* and one of *A. ornata*, it is elongate-oval and deeply notched behind, but this is, I think, due to injury.

hinder margins of the orbital bulges. The posterior is long, serrated, and extends across the palate posterior to the orbits. Lower jaw more or less truncate. Tympanum hidden or slightly

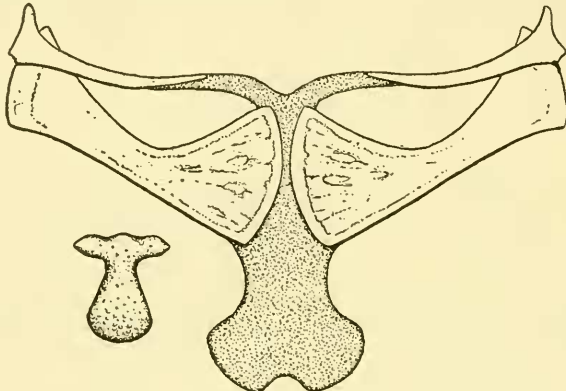


Fig. 35a.

Fig. 35.

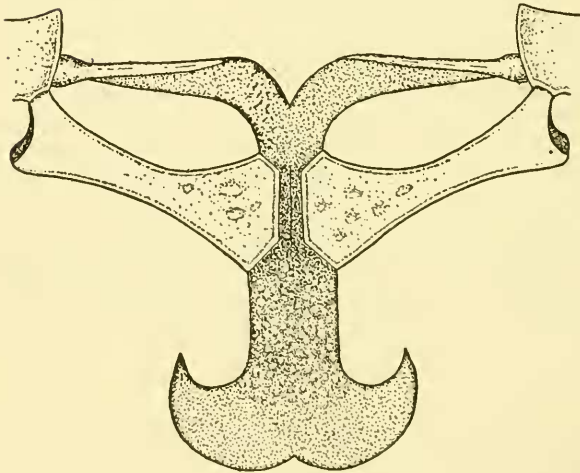


Fig. 36.

Fig. 35. Sternal apparatus of *Austrochaperina robusta*, Fry.

„ 35a. Terminal phalanx of *Austrochaperina robusta*, Fry.

„ 36. Sternal apparatus of *Chaperina polysticta*, Mchely (after Mchely).

visible. Skin smooth. Fingers and toes free, disced. Terminal phalanges stout, T shaped (fig. 35a). Outer metatarsals separated

by a groove. Diapophyses of the sacral vertebra much dilated. Coracoid (fig. 35) very strong, much dilated at the symphysis. Clavicle moderately developed, arched, the proximal end expanded and resting on the coracoid; its distal end tapering and connected with the epicoracoid by a curved band-like procoracoid cartilage. Omosternum absent. Sternum a cartilaginous plate, becoming symmetrically broader and nicked distally.

Type.—*A. robusta*, Fry.

This genus is closely allied to *Chaperina*, Mocquard, found in Borneo and New Guinea. It differs chiefly in the indistinct or hidden tympanum, the possession of two dermal palatal ridges, the comparative development of the sternal elements, and certain characters in the skull (see Appendix, p. 101). In the present genus (fig. 35) the clavicle is a strongly arched bone resting firmly on the coracoid. The procoracoid is weak and scarcely wider than the clavicle. The coracoid is a very strong unsymmetrical bone with a very wide expansion at the symphysis. The sternum has no forwardly directed processes. In *Chaperina* (fig. 36) the clavicle is weak and straight and connects with the scapular, not with the coracoid. The procoracoid cartilage is well developed and much broader than the clavicle. The coracoid is moderately developed, nearly symmetrical, and with a much smaller expansion at the symphysis. The sternum has two curved, forwardly directed, lateral processes.

Three species are recognised which may be distinguished by the following key:—

A. Snout slightly prominent.

a. First finger very small. Discs of fingers very large.....*A. ornata*.

b. First finger nearly as long as second. Discs distinct but scarcely enlarged.....*A. robusta*.

AA. Snout very prominent, longer than the orbital diameter*A. gracilipes*.

AUSTROCHAPERINA ROBUSTA, *sp. nov.*

(Figs. 35, 35a, 37, Plate viii.; figs. 2, 2a, 2b, and Plate ix.)

Habit moderate or stout. Head four-fifths to five-sixths as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana. Snout rounded, very slightly

prominent, shorter than the orbital diameter. Nostril much nearer the tip of the snout than the eye. Canthus rostralis rounded; loreal region slightly oblique, not concave. Interorbital space broader than the upper eye-lid. Tympanum indistinct, about half, or less, the diameter of the eye. Lower jaw very slightly truncate. Tongue subcircular, entire, and free for about half its length. Choanæ placed well forward, sometimes almost hidden. Palatine ridges hardly distinguishable, oblique. Anterior palatal ridge, situated between the hinder margins of the orbital bulges, represented by a single dermal lobe, or it may bear a short row of irregular papillæ. The posterior ridge is long and serrated, and

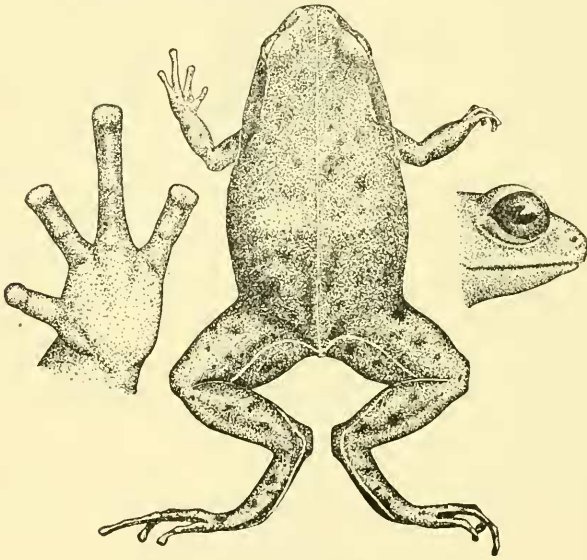


Fig. 37.

extends right across the hinder palate in front of the œsophagus. Arm weak. Fingers sub-cylindrical or depressed, bearing slightly enlarged but distinct discs. A thick fringe is sometimes present on the penultimate phalanx and between the bases of the fingers. First finger not much shorter than second, cylindrical, sometimes with a small disc. A small smooth metacarpal tubercle on the base of the first finger. Hind limb stout. Toes moderately long, depressed, or subcylindrical, the third, fourth and fifth with a more or less distinct thick fringe. Discs well developed, larger than the finger discs. A small oval inner metatarsal tubercle.

The length of the outstretched limb, from the anus to the tibio-tarsal articulation, equals the distance between the anus and the eye.² Skin smooth.

Colour (spirits).—This species presents two colour varieties.

Variety A. (fig. 37).—Upper surfaces uniform brownish, with or without a few brownish speckles, and with a fine light dorsal line running from the tip of the snout to the anus. Another light line borders the thigh posteriorly and runs to the heel. Loreal region dark brown. A dark brown band runs from behind the eye to the shoulder, passing above the tympanum. Under-surfaces lighter, uniform, or with a few faint speckles of darker brown.

Variety B. (Pl. viii., fig. 2).—Upper-surfaces uniform brownish, or speckled and spotted with darker brown. These punctulations reach the extreme in the specimen figured. The light dorsal stripe and the stripes on the limbs are absent. Otherwise as in variety A.

Total length (largest specimen), from snout to vent, 28.5 mm.

The specimen figured on Pl. viii., fig. 2, differs considerably from the Russell River specimens. It was collected for the Trustees of the Australian Museum by Mr. George Hislop in 1897 at the Bloomfield River, near Cooktown. It differs in having a broader head, shorter hind limbs, and the more accentuated markings. I have little doubt however, that it will subsequently be proved a mere variety of this variable species.

Locs.—Nine specimens from Russell River, North-east Queensland, Pl. viii., fig. 2a, and fig. 37 (Macleay Museum). One specimen (Pl. viii., figs. 2 and 2b), from Bloomfield River, near Cooktown, North-east Queensland (Australian Museum).

Type.—In the Australian Museum, Sydney.

AUSTROCHAPERINA ORNATA, *sp. nov.*

(Fig. 38).

Habit moderate. Head five-sixths as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana. Snout rounded, the nasal openings projecting

² In the specimen figured on Pl. viii., fig. 2, the length of the hind limb, from the anus to the tibio-tarsal articulation, only equals the distance between the anus and the tympanum.

slightly and giving it a somewhat truncate appearance; snout not prominent, shorter than the orbital diameter. Nostril much nearer the tip of the snout than the eye. Canthus rostralis rounded; loreal region nearly vertical, not concave. Interorbital space much broader than the upper eye-lid. Tympanum hardly distinguishable, less than half the diameter of the eye. Lower jaw

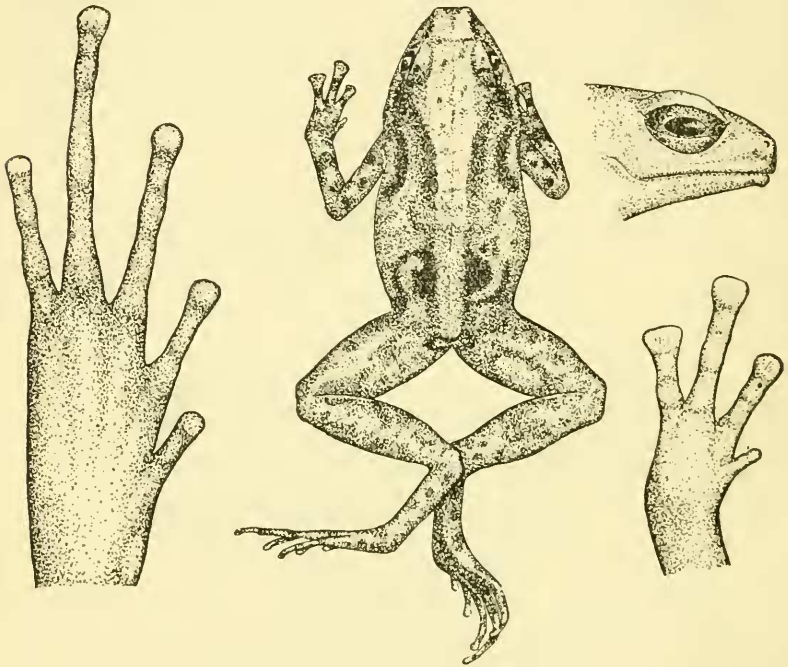


Fig. 38.

slightly truncate. Tongue suboval, entire and free behind. Choanae distinct. Palatine ridges fairly distinct, oblique. Anterior palatal ridge represented by a single, hardly distinguishable dermal lobe, situated between the hinder margins of the orbital bulges. The posterior is long and serrated, and extends across the hinder palate in front of the œsophagus. Arm weak. Fingers cylindrical, compressed at the tips into considerably enlarged discs; disc of the fourth finger much the largest. First finger very small, much shorter than second, cylindrical. Metacarpal tubercle absent. Toes moderate, longer than in the preceding species, not fringed, the discs slightly smaller than the finger discs. A very small oval inner metatarsal tubercle. The length

of the hind limb stretched out, from the anus to the tibiotarsal articulation, equals the distance between the anus and the loreal region. Skin smooth.

Colour (spirits).—Brownish above with darker brown spots. Sometimes a light silvery band commencing behind the eye-lids, narrowing and continuing to the anus as a broad dorsal stripe. Upper surface of head light silvery grey. Loreal region dark brown. A more or less broken band of dark brown commences behind the eye and continues to the axilla. In the scapular region, are two brown, light-edged spots, more or less resembling ocelli; a similar marking on each side of the urostyle. Sides and under surfaces light brown, irregularly speckled with lighter brown and yellow.

Total length, from snout to vent, 21 mm.

This species differs from the preceding chiefly in the smaller tympanum, much larger finger discs, very small first finger, and distinctive colouration.

Locs.—One specimen from Russell River, North-east Queensland, fig. 38 (Macleay Museum). One specimen from twenty-five miles inland from Cairns, North-east Queensland, collected in 1888 by Messrs E. J. Cairn and R. Grant (Australian Museum).

Type.—In the Australian Museum, Sydney.

AUSTROCHAPERINA GRACILIPES, *sp. nov.*

(Fig. 39 and Plate viii., figs. 1, 1a and 1b).

Habit slender. Head almost as long as broad. Snout rounded, depressed at the tip; pointed and produced in profile; longer than the orbital diameter. Nostril slightly nearer the tip of the snout than the eye. Canthus rostralis rounded; loreal region oblique, concave. Interorbital space much broader than the upper eye-lid. Tympanum hidden. Lower jaw distinctly truncate. Tongue elongate (injured³). Palatine ridges not distinguishable. Palate very flat; choanæ distinct. Anterior palatal ridge hardly discernible, represented by a small, sessile dermal lobe, situated between the hinder margins of the orbital bulges. Posterior ridge long and serrated, situated across the hinder palate in front of the œsophagus. Arm weak and slender. Fingers very

³ The tongue is injured posteriorly and presents a deep nick. It is considerably longer than either of the preceding species.

slender, cylindrical, with scarcely enlarged discs. First finger very small, much shorter than second. A small oval metacarpal tubercle. Hind limb moderate, thigh large. Toes long and slender, cylindrical, with small, not enlarged discs. Metatarsal tubercle absent. The length of the outstretched limb, from the anus to the tibiotarsal articulation, equals the distance between the anus and the anterior border of the eye. Skin smooth.

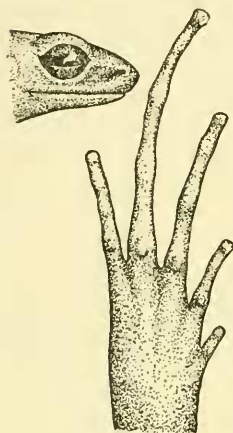


Fig. 39.

Colour (spirits).—Pinkish-brown above, with sparsely distributed dark brown spots on the legs and sides of the body. An indistinct inguinal spot present. A dark brown band starts at the nostril, passes through the eye and continues to the shoulder. Under-surfaces pale brownish, with faint brown reticulations and spots.

Total length, from snout to vent, 17 mm.

This species is distinguished from both the preceding by the produced snout, the more median situation of the nostril, the

hidden tympanum, the longer toes and smaller discs, and the more slender habit.

Loc.—A single specimen, collected for the Trustees of the Australian Museum by Messrs. C. Hedley and A. R. McCulloch at Somerset, Cape York, North Queensland, in October 1907.

Type.—In the Australian Museum, Sydney.

Although abundantly represented in New Guinea the family Engystomatidæ has not previously been recorded from the Australian continent. New Guinea, whose original stock of Engystomatidæ is of Oriental origin, is credited with thirty-one species representative of thirteen genera, showing it to be a country highly favourable to these termite-eating frogs.

During the past connection of Cape York Peninsula to Papua a considerable migration took place, whose influence on the northern and eastern coasts of Australia has resulted in the recognition of a distinct sub-region, the Papuan Sub-region of Mr. C. Hedley⁴, or as later named by Professor W. B. Spencer⁵.

⁴ Hedley—Proc. Austr. Assoc. Adv. Sci., v., 1893, p. 444.

⁵ Spencer—Rept. Horn. Sci. Exp., Summary, i., 1896, p. 172.

the Torresian Sub-region. At the time of this connection with Papua the group Engystomatidæ was probably less specialised and poorer in species than it is at present, thus accounting for the transmission of a few members only. It is true that our knowledge of this group of vertebrates is not complete, and that the rich eastern slopes of Cape York Peninsula are practically unexplored by biologists. But I think enough material has come to light to allow us to definitely draw conclusions as to the relative abundance of the families of Australian frogs. It is possible that other members of this family will be found in Australia, but we can neither expect the diversity of forms or the abundance of species found in Papua. The genus described, as would be expected, is closely allied to a genus (*Chaperina*) which, because of its comparative abundance of species and its wide distribution, is to be regarded as of the older and more primitive stock. Thus the genus *Chaperina* and a closely allied form, which might have only become differentiated after its disconnection with its original habitat, has a distribution ranging from Borneo, through New Guinea, to North Australia. The sternal apparatus has affinities to a primitive stock. This is speaking comparatively, comparing *Chaperina* with other members of the Engystomatidæ only, for the whole of this family is to be regarded as highly specialised. To quote Dr. Hans Gadow on this point—"On the whole, those genera are to be considered the most primitive which have undergone the fewest losses. Those with a complete shoulder girdle, with an omo and meta-sternum.....are necessarily the older forms." This implies that such forms as *Phrynella*, *Mantophryne*, *Cacopus*, etc., in which the precoracoids and clavicles are much modified or absent, are to be regarded as the most highly specialised.

The Ranidæ, which are also Oriental migrants have become greatly diversified in the Papuan and Melanesian Sub-regions. As far as numbers go this family is not exceptionally abundant, the whole region, Papua and Melanesia, being represented by twenty-one species confined to four genera.

Professor W. Baldwin Spencer⁶ suggests that the Hylidæ have entered Australia like the Ranidæ from the north. The author would propose that Papuasias and Melanesias have themselves been supplied by Hylidæ, with Australia as the centre of dispersion, and who in turn derived her original stock from South America, via the supposed Antarctic continent of early Tertiary times. That there has been a certain amount of interchange of

⁶ Spencer—Rept. Horn. Sci. Exp., Summary, i., 1896, p. 192.

forms there is no doubt, for four or five species occur in both Papuasia and Australia, while *Hyla infrafronata* (*H. dolichopsis*, Cope, auctorum) is known from Java, Ceram, New Guinea, New Ireland and North Australia. This is, however, easily explained if we take into consideration the existence of a connection in recent Tertiary times, between Cape York and New Guinea, which in all probability also allowed the transmission of *Phanerotis nova-guineae* into Papua and *Rana papua* into Australia. Referring again to Gadow's⁷ admirable chapters on distribution, he says of the Hylidæ, "with this exception of three closely allied species, the Hylidæ are either American or Australian. We conclude that their original home was Notogaea, and that they have spread northwards through Central and into North America. The enormous moist and steamy forests of South America naturally suggest themselves as a paradise for tree-frogs, and it is in this country, especially in the Andesian and the adjoining Central American Sub-regions, that the greatest diversity of generic and specific forms has been produced. It is all the more remarkable that similar forest regions, like those of Borneo and other Malay islands, are absolutely devoid of Hylidæ (while there are about a dozen species in Papuasia), whose place has been taken for all practical purposes by correspondingly developed Ranidæ, notably the genus *Rhacophorus*. Lastly, the fact that tropical evergreen forests of Africa and Madagascar possess no Hylidæ, but are inhabited by several kinds of tree-climbing *Rhacophorus*, points with certainty to the conclusion that the origin of this large and flourishing family of Hylidæ was not in Aretogaea."

The absence of Hylidæ in the Malay Archipelago, or more strictly speaking Siam, Borneo and Sumatra, is very striking and is in itself fatal to the theory that Papuasia could have been the centre of dispersion of Aretogæan Hylidæ. Allowing this to be possible, two questions remain to be explained. First, during the extension westwards of the three Asiatic Hylas why did they not also populate Siam, Borneo and Sumatra, through which countries they must have passed; and, allowing a rapid extension southwards to Australia and Tasmania, why did they not extend southwards at their western limit into the highly favourable forests of Africa? Secondly, it is obvious that to allow this mode of procedure we must regard the Aretogæan Hylidæ as cases of convergent evolution. As would be expected there is considerable parallelism in development amongst New World and

⁷ Gadow—Cambr. Nat. Hist., Rept. & Amph., 1901, p. 186.

Australian species, but this does not warrant our regarding the two divisions of the family Hylidæ, Arctogæan and Notogæan as instances of convergent evolution.

Turn then to the theory proposed, that Australian Hylidæ are directly of Notogæan stock, and have entered the continent from the south, not from the north.

The authenticity of the theory of an Antarctic continent, existing probably in Mesozoic times, with rays extending to South America and Australia, is by now almost generally accepted as established. Amongst the mass of evidence in favour of this connection is the presence of Cystignathous frogs in Australia. The home of the Cystignathidæ is in South America, where they are abundantly represented, and the greatest diversity of forms and the more primitive types are found there. Their distribution in the Australian continent and their dominance in the south-east corner, the Euronotian Sub-region as modified by Mr. Hedley, points to their entrance and early establishment in this corner, from where they have migrated westwards and northwards, one species only, as far as is known, entering New Guinea. Allowing this mode of procedure to explain the presence of the Cystignathidæ in Australia, it is proposed that the presence of the other dominant Arciferous family, the Hylidæ, be explained thus also. It is impossible to regard them as cases of convergent evolution, and the evidence against this view must be the evidence advanced to disprove the existence of an Antarctic continent.

Since the publication in 1882 of Dr. G. A. Boulenger's monumental "Catalogue of Amphibia in the Collections of the British Museum", numerous additions have been made to the Australian list in this class of vertebrates, both by European and Australian authors. As no list of the species described since its publication has appeared, a reference to the original description of these species is here given. Unless stated to the contrary the species are regarded as valid by the author. I have had the opportunity of examining Mr. J. Douglas Ogilby's types, and what remain of Mr. C. W. de Vis's typical specimens in the Queensland Museum. Through the kindness of Mr. J. J. Fletcher, to whom I am much indebted for his ever ready assistance, I have been enabled from time to time to compare specimens with the types in his fine collection. Of the species described since the "Catalogue" the three recently characterised by Mr. J. Lamb and *Phyllorhina frosti*, Spencer, *Hyla gilleni*, Spencer, *H. dayi*, Günther and *H. maculata*, Spencer, are the only ones that I have not examined.

RANIDÆ.

Hyla nobilis, de Vis, Proc. Roy. Soc. Q'land., i., 1884, p. 129
(= *Rana papua*, Less., *vide* Boulenger).

ENGYSTOMATIDÆ

Austrochaperina robusta, Fry (*ante*).

Austrochaperina ornata, Fry (*ante*).

Austrochaperina gracilipes, Fry (*ante*).

CYSTIGNATHIDÆ.

Hyla fenestrata, de Vis, Proc. Roy. Soc. Q'land., i., 1884, p. 128 (= *Mixophyes fasciolatus*, Günther, *vide* Boulenger).

Limnodynastes lineatus, de Vis, Proc. Linn. Soc. N. S. Wales, ix., 1884, p. 65 (= *L. peroni*, Dum. and Bibr., *vide* Boulenger).

Limnodynastes fletcheri, Boulenger, Ann. Mag. Nat. Hist. (6), ii., 1888, p. 142.

Limnodynastes marmoratus, Lamb, Ann. Q'land. Mus. No. 10, 1911, p. 28. Is probably identical with *L. fletcheri*, Boulenger.

Limnodynastes olivaceus, de Vis, Proc. Linn. Soc. N.S. Wales, ix., 1884, p. 66.

Phanerotis fletcheri, Boulenger, Proc. Linn. Soc. N. S. Wales, (2), v., 1890, p. 593.

Adelotus, Ogilby, Proc. Roy. Soc. Q'land., xx., 1907, p. 32 (for *Cryptotis*, Günther, preoccupied).

Crinia haswelli, Fletcher, Proc. Linn. Soc. N. S. Wales (2), viii., 1893, p. 522.

Crinia froggatti, Fletcher, Proc. Linn. Soc. N. S. Wales, (2), vi., 1891, p. 275 (= *C. laevis*, Günther, var. *froggatti*, Fletcher, *vide* Fletcher).

Crinia victoriana, Boulenger, Ann. Mag. Nat. Hist. (6), ii., 1888, p. 142.

- Crinia leai*, Fletcher, Proc. Linn. Soc. N. S. Wales, xxii., 1897, p. 677.
- Chiroleptes dahlui*, Boulenger, Proc. Zool. Soc., 1895, p. 867, pl. xlix., fig. 2 (= *Phractops dahlui*, Boulenger).
- Mitrolysis*, Cope, Batr. N. Amer., 1889, p. 312 (for *Chiroleptes alboguttatus*, Günther, = *Phractops*, Peters, ?).
- Philocryphus flavoguttatus*, Fletcher, Proc. Linn. Soc. N. S. Wales (2), viii., 1893, p. 233.
- Heleioporus sudelli*, Lamb, Ann. Q'land. Mus., No. 10, 1911, p. 26,
- Phyloria frosti*, Spencer, Proc. Roy. Soc. Vict. (n.s.), xiii., 1901, p. 176.

BUFONIDÆ.

- Pseudophryne dendyi*, Lucas, Proc. Roy. Soc. Vict. (n.s.), iv., 1892, p. 62. Probably *P. bibroni*, Günther.
- Pseudophryne semi-marmorata*, Lucas, Proc. Roy. Soc. Vict. (n.s.), iv., 1892, p. 63 (= *P. bibroni*, Günther, *vide* Fletcher).

HYLIDÆ.

- Hyla chloris*, Boulenger, Proc. Linn. Soc. N. S. Wales (2), vii., 1892, p. 403 (= *H. gracilentata*, Peters, var.).
- Hyla luteiventris*, Ogilby, Proc. Roy. Soc. Q'land., xx., 1907, p. 31 (= *H. gracilentata*, Peters, var.).
- Hyla gilleni*, Spencer, Rep. Horn. Sci. Exp., pt. 2, 1896, p. 173, pl. xv., figs. 14-17.
- Hyla dayi*, Günther, Nov. Zool., iv., 1897, p. 406.
- Hyla rothi*, de Vis, Proc. Linn. Soc. N. S. Wales, ix., 1884, p. 66 (= *H. peroni*, Bibron, var., *vide* Boulenger).
- Hyla ewingi*, Dum. and Bibr., var. *orientalis*, Fletcher, Proc. Linn. Soc. N. S. Wales, xxii., 1897, p. 670.
- Hyla maculata*, Spencer, Proc. Roy. Soc. Vict. (n.s.), xiii., 1901, p. 177.

Fanchonia elegans, Werner, Zool. Anz., xvi., 1893, p. 82.
(=*H. aurea*, Less., *vide* Werner).

Hyla vinosa, Lamb, Ann. Q'land. Mus., No. 10, 1911, p. 27.
This species appears to be founded on the typical Queensland form of *H. lesueuri*, D. and B.

Hyla peninsule, de Vis, Proc. Roy. Soc. Q'land., i., 1884, p. 130 (=*H. nasuta*, Gray, *vide* Boulenger).

Hyla semoni, Boettger in Semon, Zool. Forsch., v., 1894, p. 112, pl. v., fig. 1. Probably *H. nasuta*, Gray.

Hyla irrorata, de Vis, Proc. Roy. Soc. Q'land., i., 1884, p. 128.

Boulenger⁸ says that *H. irrorata* "should be compared with *Hyla infrateniata*, Günth.", doubtless meaning *H. infrafrrenata*, Günther. I am inclined to doubt the inference that *H. irrorata* is synonymous with *H. infrafrrenata* and would suggest its identity with *H. cærulea*, White. In some characters it agrees more closely with *H. infrafrrenata*, and in others with *H. cærulea*, but the description is so short there will always be the shadow of doubt. The vomerine teeth are stated by de Vis to be "in two small, rather distant groups behind the choanæ." In *H. infrafrrenata* they are between the choanæ, and although hardly behind them in *H. cærulea*, they are nearly so, being between the hinder borders, and in some cases almost behind the level. In the presence of a white mark behind the angle of the mouth it agrees with *H. infrafrrenata* and differs from *H. cærulea*, but in the occurrence of irregular white spots on groin and upper surfaces it possesses a character which is typically characteristic of *H. cærulea*. The discs of the fingers are stated to be two-fifths the tympanum. In this respect it differs considerably from both the above species, but I am inclined to overlook this, for, being the only serious difference it would not warrant this frog specific distinction, and might only have arisen as a *lapsus calami*. The main objection to regarding it as synonymous with *H. infrafrrenata* is the difference in the position of the teeth and the fact that this species is not recorded from Southern Queensland. Taking the above facts into consideration, and also that the type is lost, I would suggest that *H. irrorata* be regarded as a synonym of *H. cærulea*.

⁸ Boulenger—Ann. Mag. Nat. Hist. (v.), xvi., p. 387.

APPENDIX.

NOTES ON THE SKULL OF *AUSTROCHAPERINA* *ROBUSTA*, FRY.

(Plate ix. and fig. 40).

With but a single badly preserved specimen at my disposal for dissection, I have dealt at present with only the most important of the osteological features, the skull. As my specimen has been in weak spirits for the past thirty years the preparation has been a difficult matter, and cartilaginous parts have been removed, the cartilage being reduced to the consistency of jelly. This has, however, resulted in only one serious deficiency, the removal of the vomers, which lie attached ventrally to the cartilage of the olfactory capsules. The vomers are therefore not figured *in situ*.

As a result of the fine work of Prof. L. v. Méhely⁹ the osteology of the Engystomatidæ has been made a simple matter, and this author has shown that in this family at least, the skull exhibits good generic characters, and a striking range of variation.

Comparing the skull of *Austrochaperina* with that of *Chaperina fusca*, the typical species of the genus, figured by Prof. v. Méhely, the most important differences appear to be:—in *Austrochaperina* the nasals form a median suture, while in *Chaperina* they are separated; the palatine bones in *Austrochaperina* differ in having a distinct ridge, and a well developed palatine plate which forms a broad median suture with its fellow; the pterygoid in *Chaperina* is comparatively weak, while in *Austrochaperina* it is a strongly developed, more twisted bone. Of lesser importance are the more elongate frontoparietals and the smaller quadratomaxilla in *Austrochaperina*.

The *foramen magnum* viewed from behind is roughly oval, slightly produced above. Viewed from above it is seen to be oblique, facing slightly upwards, and concave between the condyles.

⁹ Méhely—Természetráji Füzetek., xxiv., 1901, pl. vi., figs. 4-5.

The *exoccipitals* (Plate ix., fig. 1, exoc.) are invisibly fused with the prootics laterally and dorso-laterally. Ventrally they are almost separated by a backward projection of the parasphenoid, which bone also bounds them anteriorly on the ventral surface. Dorsally they are almost separated by an endosteal rudiment of the supraoccipital (Pl. ix., fig. 1, so.). The occipital condyles (oc. con.), are situated latero-inferiorly and have the smooth articulating surfaces produced anteriorly on the ventral edge. They are separated from one another by a space equal to one and three-quarters their diameter. External to the condyles and piercing their peduncle, is a large, single foramen for the passage of the ninth and tenth nerves (*N.* 9, 10).

The *prootics* (pro.) are fused with the exoccipitals and present no sutures with these bones. Antero-mesially on the dorsal surface they lie in contact with the frontoparietals, and are covered ventrally by the lateral wings of the parasphenoid. The auditory capsules are distinctly sculptured above, showing externally the positions of the semi-circular canals. The *anterior semi-circular canal* (Pl. ix., fig. 1, a.s.c.) shows externally as a rounded ridge lying in contact with the frontoparietal, and directed backwards and inwards. It is directly continuous behind with the *posterior semi-circular canal* (Pl. ix., fig. 1, p.s.c.), which runs outwards, backwards and downwards. The *horizontal semi-circular canal* (h.s.c.) runs above the fenestra ovalis, forming the prominent lateral ridge of the capsule. The upper face of the capsule is broader than the lower and bevels away to a narrow base supported by the lateral wings of the parasphenoid, so that none of the three foramina which pierce the prootic laterally are visible from above. The *foramen ovale* (Pl. ix., fig. 2, f.o.) is large, situated nearer the ventral surface than the dorsal, and bordered above by the ridge formed by the horizontal semi-circular canal. Anteriorly each prootic is pierced by a single aperture for the transmission of the fifth and seventh nerves (*N.* 5, 7).

The *frontoparietals* (frp.) are considerably longer compared with their total width than in *Chaperina fusca*, the respective measurements being, *Austrochaperina* three-fifths as broad as long, *Chaperina* six-sevenths as broad as long. The suture with the nasal is shorter than in *Chaperina*, while the edge of the nasal in contact with the ethmoid is of greater extent. Between the two pairs of bones, nasals and frontoparietals, is a diamond-shaped space enclosing part of the ethmoid. The fontanelles are paired and separate. The *frontal fontanelles* (Pl. ix., fig. 1, f. fon.)

are moderately large, and broader behind than in front; the *parietal fontanelles* (Pl. ix., fig. 1, *p. fon.*) are much smaller, about one-quarter the size of the frontal, and are sub-circular and more widely separated; they are separated by half their width from each other, and from the frontal fontanelles. Posterio-laterally the frontoparietals project slightly on to the auditory capsules, forming a small postorbital process, and then run backwards and inwards along the inner border of the anterior semi-circular canal. Their posterior edge is raised slightly into a bony ridge, and is produced into several weak upward projections. In the inter-orbital region they project laterally and form a ridge which terminates anteriorly on the ethmoid.

The *nasals* (*na.*) are thin, slightly bilobed, and strongly arcuate bones. They form a median suture, thus differing from *Chaperina*. Their hinder edge though sinuate is transverse, which applies also to the fronto- and ethmo-nasal sutures. In front the nasal region is narrow and emarginate, and the bulging of the downturned nasal roofs gives a somewhat bilobate appearance to the snout. The premaxillæ are doubtfully visible from above. The nasal is united by the cartilaginous sub-nasal lamina to the maxillæ and premaxillæ, which cartilage is pierced near the nasal process of the premaxillæ by the nostril. This cartilage is undifferentiated owing to the bad condition of the specimen dissected, and the labial cartilages are lost. The nasal sends off a spike posteriorly which rests on the outer third of the palatine. The *septum nasi* (Pl. ix., fig. 2, *s.n.*) is rather delicate.

The large *parasphenoid* (Pl. ix., fig. 2, *psph.*) reaches practically the limit of its development, underlying the whole of the basis cranii, and auditory capsules. In a few respects this bone differs from the same in *Chaperina fusca*. It forms a suture with the palatines which in *Chaperina* underlie it; the length is only nine-elevenths as long as the greatest width, while in *Chaperina* it is sixteen-seventeenths. It enlarges a little in the interorbital region but narrows again slightly in front of the auditory capsules. The posterior border slants obliquely backwards from the lateral otic extremity almost to the foramen magnum.

The "girdle-bone," *sphenethmoid* or *ethmoid* (*eth.*), is well developed and bounds the whole of the anterior third of the cranial box, but is visible externally only on the sides anterior to the orbitosphenoid cartilage, dorso-laterally, and as a diamond-shaped area situated between the nasals and the frontoparietals. It projects anteriorly beyond the palatine expansions into the

olfactory region as two rounded prominences (a.p.e.). Situated under the projecting dorso-lateral ridge is a small aperture, probably for the passage of the cerebral-carotid artery. The ventral border projects posteriorly into the floor of the orbito-sphenoidal region, thus differing from *Chaperina*, in which the postero-ventral edge is broadly emarginate.

The palato-quadrate "bow" is very strong, and is stronger than in *Chaperina fusca*. This applies more to the pterygoid and suspensorial segments of the arch, the palatine element being of much the same development.

The *palatine bone* (pal.) is nearly straight and sub-cylindrical; it is stouter and slightly arched towards the outer third of its length. Mesially it broadens out into a large flat plate (Pl. ix., fig. 2, p.pl.) which forms a suture in the mid-line with its fellow, and posteriorly with the parasphenoid. This last character, the *palatine plate* is characteristic, and is not present in *Chaperina fusca*. In that genus the palatine is not cylindrical but flattened, and produced anteriorly into a process underlying the vomer, which however could not be considered homologous with the palatine plate. The ethmoidal segment or anterior third of the palatine, is raised into a distinct keel, which does not continue to the median suture of the plates. By the possession of this keel it also differs from *Chaperina fusca*. The post-palatine segment forms a suture with the pterygoid, and is supported by the palatine lamina of the maxilla.

The *pterygoid* (pt.) is a large sigmoid bone, which attains a greater development than in *Chaperina fusca*. Its anterior end forms a suture with and lies over the palatine, while the rest of the anterior third forms a long sinuate suture with the maxilla, and is supported by the palatine lamina of that bone. The pedicle branch is short and twisted. The posterior segment runs along the inner and posterior side of the suspensorium. This bone is compressed, and bears a dorsal and ventral ridge, giving it the characteristic twisted appearance.

The *paraquadrate*, *tympanic* or *squamosal* (pqu.), is moderately developed and well ossified. The main shaft is spatulate and welded on to the suspensorium anteriorly. The otic process is thin and curved with an angular posterior edge. The *zygomatic process* (z. pr.) is somewhat irregular and slightly curved, being directed forwards and inwards.

The *quadrate* (qu.) is stout, bears a rather small condyle, and forms the core of the suspensorium. Seen from above it appears wedged in between the distal half of the paraquadrate and the

pterygoid. Ventrally it forms the large mass of the suspensorium anterior to the pterygoid. Anteriorly it is fused with the short stout quadratomaxilla.

The *quadratomaxilla* or *quadratojugal* (qm.), is short and stout, more so than in *Chaperina fusca*, and forms an oblique suture with the maxilla anteriorly, and is continuous with the quadrate posteriorly. It is compressed and bears a ventral and dorsal ridge which are continuous with the same ridges of the maxilla.

The *maxilla* (mx.) is very compressed and ribbon-like posteriorly, but strengthens towards its junction with the pterygoid. At this junction is given off on the inner side, the *palatine lamina* (Pl. ix., fig. 2, p.l.). This plate is well developed and is widest at its union with the same lamina of the premaxilla. The maxilla is produced ventrally along its whole length into a sharp, biting edge, while above, towards its anterior end, is developed an incurving crest, which attains its greatest height at a level with the hinder margin of the nasals. From this point it slants forward, decreasing in size, to a blunt tip, which overlies the posterior edge of the premaxilla.

The *premaxilla* (Pl. ix., fig. 2, pmx.) are moderately developed. The inner edge of the left lies slightly inside that of the right, and the palatine lamina lies under the inner edge. This shingling of the bones is continued still further, for both premaxilla laminae underlie the same elements of the maxilla. Each bears a sharp biting edge ventrally, which is flush with that of the maxilla. The nasal process is given off dorsally, and runs upwards and bends angularly outwards, reaching almost to the nostril.

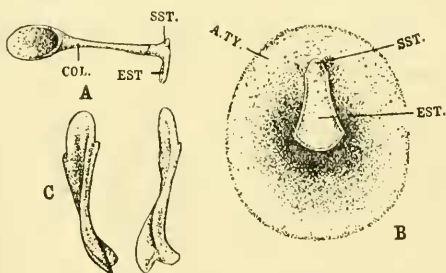


Fig. 40. A. Columella. B. Auditory opening, tympanic membrane removed. C. Vomer, dorsal and lateral view.

The *vomers* (fig. 40 c) are small twisted bones which lie between the anterior process of the ethmoid (a.p.e.) and the terminal portion of the palatine lamina of the maxilla. Owing to the condition of the cartilage of the nasal floor, these bones were removed and cannot be figured *in situ*.

The *stapes* is very large and hollow, and plainly visible from above. It covers the foramen ovale, resembling the attachment of a Limpet shell. Clamped to its apex is the saucer-shaped proximal expansion of the columella. The *columella* (fig. 40 a, col.) is long, straight and cylindrical. Proximally it extends into a shallow saucer-shaped expansion which is applied to the *stapes* dorsally. The columella is attached distally to a pedate, cartilaginous *extrastapedial* (fig. 40, a and b, est.), which bears dorsally a small *suprastapedial bud* (fig. 40, a and b, sst.). The *annulus tympanicus* (fig. 40 b, a.ty.) supports the tympanic membrane, which rests on the pedate outer surface of the *extrastapedial* cartilage.

NOTE.—Since compiling the list on p. 98 I have received Co-Types of *Limnodynastes marmoratus*, Lamb, and *Heleioporus sudelli*, Lamb, and the Type of *Hyla vinosa*, Lamb. For this privilege I am indebted to Dr. R. Hamlyn Harris, Director, and Mr. H. A. Longman of the Queensland Museum. It is evident that they all belong to known species.

Hyla vinosa, Lamb, is a varietal form of *H. lesueuri*, D. & B., and should designate Queensland examples of this species.

Limnodynastes marmoratus, Lamb, is identical with *L. fletcheri*, Boulenger.

Heleioporus sudelli, Lamb, cannot be specifically separated from *H. pictus*, Peters, the only difference being the absence of a black tip to the metatarsal tubercle.